BY **SPFA'S CONSULTANT COMMITTEE, MASON KNOWLES, ROGER MORRISON, PHIL ROBARGE, JOHN HATFIELD, ROB SMITH**

SPFA gets calls regularly from customers, designers, architects and others looking for straight answers to their questions on SPF. Here is a question received recently that our panel of experts addressed:

Question? What is meant by a "secure" substrate?

An excellent rule to practice when applying spray polyurethane foam (SPF) is to only spray to a dry, clean and secure substrate. Dry and clean are fairly obvious and readily determined; but substrate security can be a complex subject, fraught with hidden difficulties.

Compared with structural construction materials, SPF is not particularly dimensionally stable. That is, it contracts and expands. SPF initially contracts or shrinks as the blowing agent gases cool. Anyone who has sprayed foam onto a plastic or cardboard sheet has noticed that the foam shrinkage distorts the foam panel into a cup- or dish-like shape. SPF's response to humid aging is a standard physical property test with total volume change of up to 15 percent being acceptable.

SPF's tendency to expand and contract, and the subsequent stresses and forces, can be handily dealt with in the field: **only spray to secure substrates**. A secure substrate will absorb the stresses and transfer them to the building structure. An insecure substrate will not transfer the stresses and some element within the building assembly will fail. (Note: Substrate failures of this type do not include SPF blisters or delamination wherein the SPF separates from itself or its substrate; substrate failures occur when the SPF is well adhered to the substrate but the substrate itself cannot transfer SPF's stresses to suitable structural building elements.)

Substrate security issues generally fall into one of three classes:

1. Improperly secured structural substrate. Example: Plywood sheathing is not properly nailed to the studding and pulled loose or distorted.
2. Membrane substrates are only partially or intermittently attached to the structure. Examples: A BUR secured to a parapet but loosely adhered to the roof deck; a mechanically attached single-ply membrane.
3. Materials between membranes or other assembly components that are subject to cohesive failure. Examples: Coal tar BUR membranes; waterproofing compounds.

Failures may result in one or more of the following conditions:

1. Structural failure wherein a building component is loosened or fails.
2. Appearance failure wherein a building assembly element is visibly distorted.
3. Functional failure wherein the SPF's thermal, moisture and air leakage resistance is compromised.

Case Study 1: SPF shrinkage caused roofs to structurally fail at edges and parapets. In this case, the SPF applicator applied unusually thick SPF (as much as 5–6 inches) onto several existing BURs. Contractive forces were sufficient to pull parapet walls in toward the field of the roof, cracking masonry joints and loosening brickwork; or lift up roof edges, exposing the interior to water intrusion. Investigation revealed the following:

- The underlying roof membranes (i.e., the SPF substrate) were securely attached to the roof edges or parapets but were poorly attached to the roof deck; and
- The contractive forces (shrinkage) of the SPF was proportional to the volume or mass of SPF adhered to the loose membranes (i.e., the thicker the foam, the greater the force).

Damage could have been prevented or mitigated by:

- Applying less thickness of SPF at the roof perimeters.
- Fastening the existing roof membrane in perimeter areas.
- Removing the existing roof in perimeter areas and applying SPF directly to the roof deck.

Case Study 2: An SPF roof was applied directly to a single-ply membrane; the expansion of SPF caused the roof surface to "mound up" between fasteners. The SPF was well adhered to the existing single-ply membrane but that membrane was only intermittently secured (mechanically fastened) to the roof deck. The result was an appearance failure (although roof traffic could have eventually caused other problems).

Failure could have been avoided by securing the substrate by:

- Tearing off the single-ply membrane and applying SPF directly to the roof deck or a recover board fastened to the roof deck.
- Covering the single-ply membrane with a mechanically fastened recover board and applying SPF to it.

Case Study 3: SPF insulation was applied to a waterproofing system that had been applied to a structural concrete, subterranean residence; shrinkage of the SPF caused the waterproofing

Photo courtesy of Nelson & McClure, PLLC

system to fail cohesively resulting in a crack in the insulation and waterproofing (and leakage). Investigation revealed that the SPF was well adhered to the waterproofing system but the waterproofing compound itself (a spray-applied, water-based, modified asphalt emulsion) was incapable of transferring the shrinkage forces into the structural concrete.

Failure could have been avoided by spraying the SPF directly to the concrete structure and applying the waterproofing to the exterior surface of the foam. o

UPCOMING EVENTS 2013-14

2013 Polyurethanes Technical Conference
September 23–25, 2013
Phoenix, Ariz.
http://polyurethane.americanchemistry.com/

2013 Excellence in Building Conference & EXPO
September 24–26, 2013
Phoenix, Ariz.
https://www.eeba.org/conference/

ICAA Convention & Trade Show
October 3–5, 2013
Tucson, Ariz.
www.insulate.org

World of Concrete
January 20–24, 2014
Las Vegas, Nev.
www.worldofconcrete.com

SprayFoam Convention & Expo 2014
January 26–29, 2014
Palm Springs, Calif.
www.sprayfoam.org

NAHB International Builders' Show
February 4–6, 2014
Las Vegas, Nev.
www.buildersshow.com

International Roofing Expo
February 26–28, 2014
Las Vegas, Nev.
www.theroofingexpo.com

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on thermal insulation. Two members of SPFA, Luke Nolan of Central Coating Company, and James Morshead of SDI Insulation, testified in two different legislative committees in opposition to the bill and pointed out how difficult it would be to achieve California's energy efficiency goals without high-efficiency foam insulation. In addition, several California-based contractors and SPF systems house suppliers to California signed on to an EEFC-led opposition letter and several submitted individual letters as well.

WHAT CAN YOU DO?

As a sprayfoam contractor or supplier, you already know about the energy efficient attributes of SPF. Visit the EEFC website http://eefc.americanchemistry.com to learn more about how FRs work, how they have been studied and why they are important in the products you install. When proposals in your state arise that may reduce fire safety or eliminate FRs in foam plastic insulation, speak out and educate your legislators and your customers about the import functions they serve. o